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A NOTE ON REDUCTION IN THE MATURATION OF MALE EGGS IN APHIS.

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In discussing the unpaired heterochromosome in aphids, in 1908,¹ I expressed the opinion that the two heterochromosomes of the parthenogenetic generations must pair before maturation of the male-producing eggs, and separate in the maturation mitosis, one undivided heterochromosome going into the polar body while its mate remains in the egg. The only evidence which I could give in favor of this surmise was two equatorial plates where seven chromosomes appeared in the maturation of parthenogenetic eggs, instead of the eight chromosomes characteristic of the species (Plate II., Figs. 52 and 53). The largest of the seven chromosomes was evidently equal in volume to the sum of the two largest in the plate containing eight. I have never found the males of this species, the parthenogenetic generations continuing up to the time when the host plants are killed by frost. The probability is that a few scattered sexual forms occur among the parthenogenetic, and that the eggs with seven chromosomes were male-producing eggs.

In many species of aphids the same individual may produce both males and females and often parthenogenetic offspring also, making it very difficult to be certain that one has the male eggs. In the dimorphic red and green aphid found on *Enothera biennis*, however, the rule is, that in October parthenogenetic young cease to appear; apterous mothers produce only male, and winged mothers only female offspring. Only two exceptions to this rule have been observed. Two years ago I had one brood of males produced by a winged mother, and recently, in examining sections of an apterous specimen, I found four large parthenogenetic embryos, while all of the smaller embryos were male. The change here from parthenogenetic to sexual reproduction came during a generation instead of between generations.

¹ "An Unpaired Heterochromosome in the Aphids," *Journ. Exp. Zool.*, Vol. VI., No. 1, Jan., 1909.

This year an unusual number of the apterous, male-producing individuals were secured. Some were fixed and sectioned, others dissected and the eggs and embryos studied in Schneider's aceto-carmine. The sections gave no favorable stages. Out of a large

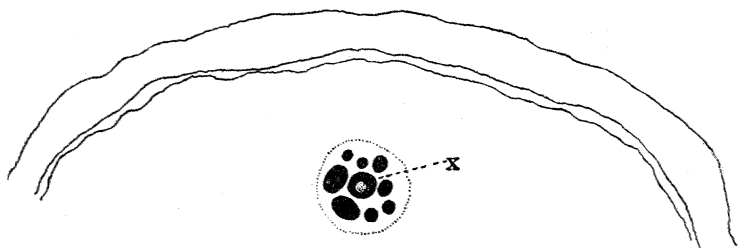


FIG. 1. Equatorial plate of maturation mitosis of male aphid egg. Outline of egg and membrane shown above. *x*, the double chromosome. Zeiss 1.5-6, cam.

number of aceto-carmine preparations, one egg was found which had the maturation spindle in metaphase. This was taken from an individual in which the older embryos were certainly male. The equatorial plate contained nine chromosomes, ten being the

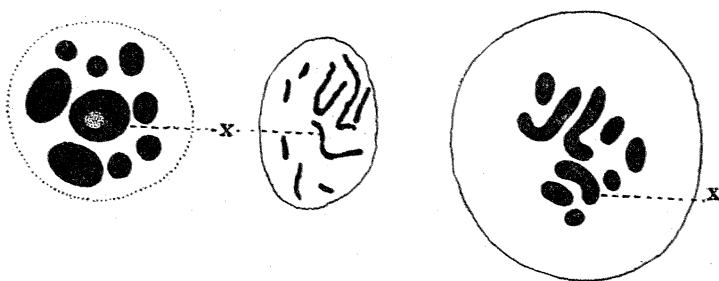


FIG. 2. Same equatorial plate drawn with Zeiss 1.5-12.

FIG. 3. Nucleus of embryonic cell (δ) in prophase. *x*, the unpaired heterochromosome. Zeiss 1.5-6.

FIG. 4. Male embryonic cell in metaphase. *x*, the unpaired heterochromosome. Zeiss 1.5-12.

number in non-sexual parthenogenetic eggs ('05, Pl. I., Figs. 7 and 12¹). This metaphase is shown in Figs. 1 and 2. The chromosome in the center of the group is the double one. In the first spermatocyte the lagging heterochromosome is the

¹ "A Study of the Germ Cells of *Aphis rosæ* and *Aphis anotheræ*," *Journ. Exp. Zool.*, Vol. II., No. 3, Aug., 1905.

second in size ('09, Pl. II., Figs. 54, 56, 57¹) and here it is evidently the two second in size, which have fused to form the large vacuolated chromosome x . No prophases or anaphases were found.

In the young male embryos many cells were in mitosis and in a few cases it was possible to count and draw the chromosomes. Fig. 3 is a nucleus in prophase flattened so that the nine chromosomes are nearly in the same plane. It will be seen that the two longest form a pair, while the next in size is unpaired. Fig. 4 is a metaphase from another embryo. The unpaired chromosome is again the second in size.

This evidence, so far as it goes, indicates that one whole chromosome goes into the polar body of the male egg, leaving

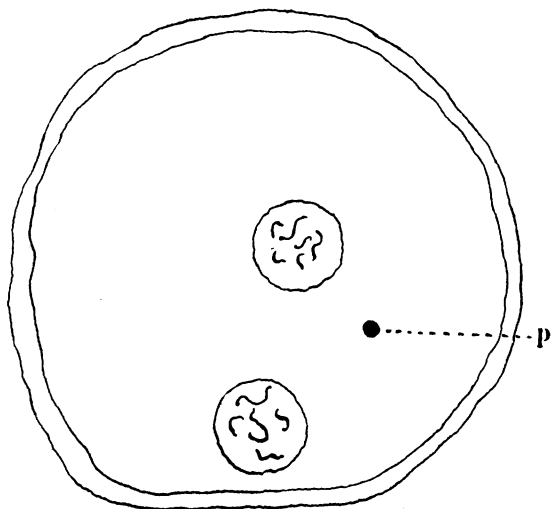


FIG. 5. Male egg showing the single polar body (p) and two nuclei. Zeiss 1.5-2.

the somatic number for the male individual reduced by one. Ordinarily one would not lay much stress on the conditions observed in a single egg, but considering the difficulties involved in securing favorable stages of maturation in male eggs of aphids, and the fact that the observations are in accord with Morgan's²

¹ "An Unpaired Heterochromosome in the Aphids," *Journ. Exp. Zööl.*, Vol. VI., No. 1, Jan., 1909.

² "A Biological and Cytological Study of Sex Determination in Phylloxerans and Aphids," *Journ. Exp. Zööl.*, Vol. VII., No. 2, Sept., 1909.

observations on male eggs of *Phylloxera*, it seems desirable to bring the results obtained from this autumn's collections of the *Enothera* aphid, to the notice of those interested in the subject.

In a recent paper, entitled "Mendelian Inheritance of Sex," Hagedoorn has quoted me as authority for a statement that male aphid eggs give off two polar bodies. I have found only one polar body in male and other parthenogenetic eggs, and have so stated the fact with all the evidence at hand ('05, Pl. II., Figs. 17 and 18, and text p. 317). Fig. 5 shows one of many early segmentation stages of male eggs found in aceto-carminc preparations, showing only one polar body

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